

```

>milkflavour.A<-c(7,4,5,9,5,8,5,6,7,9,8,8,5,8,8,8,6,6,6,7,7,9,8,7,8,9,7,8,4,7,4,5,9,6,4,2,4,6,6,5,4,
3,8,4,3,8,8,7,5,6,5,8,3)
>milkflavour.B<-c(5,5,7,7,7,8,8,7,7,8,9,7,5,7,7,8,8,8,8,7,7,6,8,6,6,6,9,6,9,7,6,6,6,8,6,6,8,6,5,8,3,6
,7,4,3,8,7,8,6,6,8,7,4)
>milkflavour.C<-c(5,4,5,6,5,5,7,7,7,7,8,8,7,8,8,7,7,6,7,6,8,6,8,2,7,7,9,6,8,3,6,6,6,8,7,5,7,7,8,7,6,7,5
,4,4,2,8,6,7,4,5,8,8,4)
>milkflavour.D<-c(5,5,7,7,7,6,7,5,7,8,8,6,6,6,8,7,8,5,8,7,8,6,7,9,7,6,9,7,9,9,6,6,8,8,7,7,8,6,8,6,7,6,
4,8,3,7,8,8,6,5,7,8,7,6)
>milkflavour.E<-c(3,7,2,4,8,6,6,6,7,8,7,9,5,7,8,7,8,7,7,8,7,6,6,4,4,7,7,7,8,9,6,4,8,9,7,6,7,8,3,4,6,4,5
,6,4,8,9,7,6,4,8,6,8,5)
>milkflavour.F<-c(3,6,2,8,9,6,6,7,7,8,8,7,6,7,8,5,8,4,8,8,7,6,7,4,8,7,8,6,8,8,6,4,6,9,6,6,5,8,7,6,7,4,6
,7,4,6,9,5,5,4,6,7,7,4)
>milkflavour.G<-c(7,8,5,4,7,8,3,7,6,8,7,7,4,7,8,5,8,6,7,8,7,6,7,6,8,6,7,6,8,9,7,6,7,9,7,7,6,6,3,5,6,3,
6,5,4,4,9,7,8,5,8,7,7,4)
>milkflavour.H<-c(3,5,2,5,4,6,3,7,7,8,8,6,6,6,8,6,8,4,7,7,7,7,7,4,5,8,7,6,8,9,7,4,7,9,7,8,7,3,4,6,5,6,
6,7,4,6,8,6,7,5,7,7,8,3)
>milkflavour.I<-c(3,5,5,6,2,7,6,6,7,9,8,5,7,7,7,7,8,3,6,7,7,7,8,3,7,4,8,6,8,7,7,6,6,8,6,8,1,6,5,5,5,3,6,
4,3,2,8,6,5,4,5,7,8,2)
>flavour<-c(milkflavour.A,milkflavour.B,milkflavour.C,milkflavour.D,milkflavour.E,milkflavour.F,milk
flavour.G,milkflavour.H,milkflavour.I)
> samples.A<-rep("A",times=54)
> samples.B<-rep("B",times=54)
> samples.C<-rep("C",times=54)
> samples.D<-rep("D",times=54)
> samples.E<-rep("E",times=54)
> samples.F<-rep("F",times=54)
> samples.G<-rep("G",times=54)
> samples.H<-rep("H",times=54)
> samples.I<-rep("I",times=54)
>samples<-factor(c(samples.A,samples.B,samples.C,samples.D,samples.E,samples.F,samples.G,sa
mples.H,samples.I))
> assessors<-factor(rep(c(1:54),times=9))
> results<-data.frame(samples=factor(samples),assessors=factor(assessors),flavour=flavour)
> results

```

	samples	assessors	flavour
1	A	1	7
2	A	2	4
3	A	3	5
4	A	4	9
5	A	5	5
6	A	6	8
7	A	7	5
8	A	8	6
9	A	9	7

10	A	10	9
11	A	11	8
12	A	12	8
13	A	13	5
14	A	14	8
15	A	15	8
16	A	16	8
17	A	17	8
18	A	18	6
19	A	19	6
20	A	20	6
21	A	21	7
22	A	22	7
23	A	23	9
24	A	24	8
25	A	25	7
26	A	26	8
27	A	27	9
28	A	28	7
29	A	29	8
30	A	30	4
31	A	31	7
32	A	32	4
33	A	33	5
34	A	34	9
35	A	35	6
36	A	36	4
37	A	37	2
38	A	38	4
39	A	39	6
40	A	40	6
41	A	41	5
42	A	42	4
43	A	43	3
44	A	44	8
45	A	45	4
46	A	46	3
47	A	47	8
48	A	48	8
49	A	49	7
50	A	50	5
51	A	51	6
52	A	52	5
53	A	53	8

54	A	54	3
55	B	1	5
56	B	2	5
57	B	3	7
58	B	4	7
59	B	5	7
60	B	6	8
61	B	7	8
62	B	8	7
63	B	9	7
64	B	10	8
65	B	11	9
66	B	12	7
67	B	13	5
68	B	14	7
69	B	15	7
70	B	16	8
71	B	17	8
72	B	18	8
73	B	19	8
74	B	20	7
75	B	21	7
76	B	22	6
77	B	23	8
78	B	24	6
79	B	25	6
80	B	26	6
81	B	27	9
82	B	28	6
83	B	29	9
84	B	30	7
85	B	31	6
86	B	32	6
87	B	33	6
88	B	34	8
89	B	35	6
90	B	36	6
91	B	37	6
92	B	38	8
93	B	39	6
94	B	40	5
95	B	41	8
96	B	42	3
97	B	43	6

98	B	44	7
99	B	45	4
100	B	46	3
101	B	47	8
102	B	48	7
103	B	49	8
104	B	50	6
105	B	51	6
106	B	52	8
107	B	53	7
108	B	54	4
109	C	1	5
110	C	2	4
111	C	3	5
112	C	4	6
113	C	5	5
114	C	6	5
115	C	7	7
116	C	8	7
117	C	9	7
118	C	10	7
119	C	11	8
120	C	12	8
121	C	13	7
122	C	14	8
123	C	15	8
124	C	16	7
125	C	17	7
126	C	18	6
127	C	19	7
128	C	20	6
129	C	21	8
130	C	22	6
131	C	23	8
132	C	24	2
133	C	25	7
134	C	26	7
135	C	27	9
136	C	28	6
137	C	29	8
138	C	30	3
139	C	31	6
140	C	32	6
141	C	33	6

142	C	34	8
143	C	35	7
144	C	36	5
145	C	37	7
146	C	38	7
147	C	39	8
148	C	40	7
149	C	41	6
150	C	42	7
151	C	43	5
152	C	44	4
153	C	45	4
154	C	46	2
155	C	47	8
156	C	48	6
157	C	49	7
158	C	50	4
159	C	51	5
160	C	52	8
161	C	53	8
162	C	54	4
163	D	1	5
164	D	2	5
165	D	3	7
166	D	4	7
167	D	5	7
168	D	6	6
169	D	7	7
170	D	8	5
171	D	9	7
172	D	10	8
173	D	11	8
174	D	12	6
175	D	13	6
176	D	14	6
177	D	15	8
178	D	16	7
179	D	17	8
180	D	18	5
181	D	19	8
182	D	20	7
183	D	21	8
184	D	22	6
185	D	23	7

186	D	24	9
187	D	25	7
188	D	26	6
189	D	27	9
190	D	28	7
191	D	29	9
192	D	30	9
193	D	31	6
194	D	32	6
195	D	33	8
196	D	34	8
197	D	35	7
198	D	36	7
199	D	37	8
200	D	38	6
201	D	39	8
202	D	40	6
203	D	41	7
204	D	42	6
205	D	43	4
206	D	44	8
207	D	45	3
208	D	46	7
209	D	47	8
210	D	48	8
211	D	49	6
212	D	50	5
213	D	51	7
214	D	52	8
215	D	53	7
216	D	54	6
217	E	1	3
218	E	2	7
219	E	3	2
220	E	4	4
221	E	5	8
222	E	6	6
223	E	7	6
224	E	8	6
225	E	9	7
226	E	10	8
227	E	11	7
228	E	12	9
229	E	13	5

230	E	14	7
231	E	15	8
232	E	16	7
233	E	17	8
234	E	18	7
235	E	19	7
236	E	20	8
237	E	21	7
238	E	22	6
239	E	23	6
240	E	24	4
241	E	25	4
242	E	26	7
243	E	27	7
244	E	28	7
245	E	29	8
246	E	30	9
247	E	31	6
248	E	32	4
249	E	33	8
250	E	34	9
251	E	35	7
252	E	36	6
253	E	37	7
254	E	38	8
255	E	39	3
256	E	40	4
257	E	41	6
258	E	42	4
259	E	43	5
260	E	44	6
261	E	45	4
262	E	46	8
263	E	47	9
264	E	48	7
265	E	49	6
266	E	50	4
267	E	51	8
268	E	52	6
269	E	53	8
270	E	54	5
271	F	1	3
272	F	2	6
273	F	3	2

274	F	4	8
275	F	5	9
276	F	6	6
277	F	7	6
278	F	8	7
279	F	9	7
280	F	10	8
281	F	11	8
282	F	12	7
283	F	13	6
284	F	14	7
285	F	15	8
286	F	16	5
287	F	17	8
288	F	18	4
289	F	19	8
290	F	20	8
291	F	21	7
292	F	22	6
293	F	23	7
294	F	24	4
295	F	25	8
296	F	26	7
297	F	27	8
298	F	28	6
299	F	29	8
300	F	30	8
301	F	31	6
302	F	32	4
303	F	33	6
304	F	34	9
305	F	35	6
306	F	36	6
307	F	37	5
308	F	38	8
309	F	39	7
310	F	40	6
311	F	41	7
312	F	42	4
313	F	43	6
314	F	44	7
315	F	45	4
316	F	46	6
317	F	47	9



318	F	48	5
319	F	49	5
320	F	50	4
321	F	51	6
322	F	52	7
323	F	53	7
324	F	54	4
325	G	1	7
326	G	2	8
327	G	3	5
328	G	4	4
329	G	5	7
330	G	6	8
331	G	7	3
332	G	8	7
333	G	9	6
334	G	10	8
335	G	11	7
336	G	12	7
337	G	13	4
338	G	14	7
339	G	15	8
340	G	16	5
341	G	17	8
342	G	18	6
343	G	19	7
344	G	20	8
345	G	21	7
346	G	22	6
347	G	23	7
348	G	24	6
349	G	25	8
350	G	26	6
351	G	27	7
352	G	28	6
353	G	29	8
354	G	30	9
355	G	31	7
356	G	32	6
357	G	33	7
358	G	34	9
359	G	35	7
360	G	36	7
361	G	37	6

362	G	38	6
363	G	39	3
364	G	40	5
365	G	41	6
366	G	42	3
367	G	43	6
368	G	44	5
369	G	45	4
370	G	46	4
371	G	47	9
372	G	48	7
373	G	49	8
374	G	50	5
375	G	51	8
376	G	52	7
377	G	53	7
378	G	54	4
379	H	1	3
380	H	2	5
381	H	3	2
382	H	4	5
383	H	5	4
384	H	6	6
385	H	7	3
386	H	8	7
387	H	9	7
388	H	10	8
389	H	11	8
390	H	12	6
391	H	13	6
392	H	14	6
393	H	15	8
394	H	16	6
395	H	17	8
396	H	18	4
397	H	19	7
398	H	20	7
399	H	21	7
400	H	22	7
401	H	23	7
402	H	24	4
403	H	25	5
404	H	26	8
405	H	27	7

406	H	28	6
407	H	29	8
408	H	30	9
409	H	31	7
410	H	32	4
411	H	33	7
412	H	34	9
413	H	35	7
414	H	36	8
415	H	37	7
416	H	38	3
417	H	39	4
418	H	40	6
419	H	41	5
420	H	42	6
421	H	43	6
422	H	44	7
423	H	45	4
424	H	46	6
425	H	47	8
426	H	48	6
427	H	49	7
428	H	50	5
429	H	51	7
430	H	52	7
431	H	53	8
432	H	54	3
433	I	1	3
434	I	2	5
435	I	3	5
436	I	4	6
437	I	5	2
438	I	6	7
439	I	7	6
440	I	8	6
441	I	9	7
442	I	10	9
443	I	11	8
444	I	12	5
445	I	13	7
446	I	14	7
447	I	15	7
448	I	16	7
449	I	17	8

450		18	3
451		19	6
452		20	7
453		21	7
454		22	7
455		23	8
456		24	3
457		25	7
458		26	4
459		27	8
460		28	6
461		29	8
462		30	7
463		31	7
464		32	6
465		33	6
466		34	8
467		35	6
468		36	8
469		37	1
470		38	6
471		39	5
472		40	5
473		41	5
474		42	3
475		43	6
476		44	4
477		45	3
478		46	2
479		47	8
480		48	6
481		49	5
482		50	4
483		51	5
484		52	7
485		53	8
486		54	2

```
> library(asbio)
```

```
> tukey.add.test(results$flavour,results$samples,results$assessors)
```

Tukey's one df test for additivity

data: results\$samples and results\$assessors on results\$flavour

F = 10.3219, num.df = 1, denom.df = 423, p-value = 0.001415

```

> milkflavour<- matrix(c
(7,4,5,9,5,8,5,6,7,9,8,8,5,8,8,8,6,6,6,7,7,9,8,7,8,9,7,8,4,7,4,5,9,6,4,2,4,6,6,5,4,3,8,4,3,8,8,7,5,6,5
,8,3,5,5,7,7,7,8,8,7,7,8,9,7,5,7,7,8,8,8,8,7,7,6,8,6,6,6,9,6,9,7,6,6,6,8,6,6,6,8,6,5,8,3,6,7,4,3,8,7,8,6
,6,8,7,4,5,4,5,6,5,5,7,7,7,7,8,8,7,8,8,7,7,6,7,6,8,6,8,2,7,7,9,6,8,3,6,6,6,8,7,5,7,7,8,7,6,7,5,4,4,2,8,6
,7,4,5,8,8,4,5,5,7,7,7,6,7,5,7,8,8,6,6,6,8,7,8,5,8,7,8,6,7,9,7,6,9,7,9,9,6,6,8,8,7,7,8,6,8,6,7,6,4,8,3,7
,8,8,6,5,7,8,7,6,3,7,2,4,8,6,6,6,7,8,7,9,5,7,8,7,8,7,7,8,7,6,6,4,4,7,7,7,8,9,6,4,8,9,7,6,7,8,3,4,6,4,5,6
,4,8,9,7,6,4,8,6,8,5,3,6,2,8,9,6,6,7,7,8,8,7,6,7,8,5,8,4,8,8,7,6,7,4,8,7,8,6,8,8,6,4,6,9,6,6,5,8,7,6,7,4
,6,7,4,6,9,5,5,4,6,7,7,4,7,8,5,4,7,8,3,7,6,8,7,7,4,7,8,5,8,6,7,8,7,6,7,6,8,6,7,6,8,9,7,6,7,9,7,7,6,6,3,5
,6,3,6,5,4,4,9,7,8,5,8,7,7,4,3,5,2,5,4,6,3,7,7,8,8,6,6,6,8,6,8,4,7,7,7,7,4,5,8,7,6,8,9,7,4,7,9,7,8,7,3
,4,6,5,6,6,7,4,6,8,6,7,5,7,7,8,3,3,5,5,6,2,7,6,6,7,9,8,5,7,7,7,7,8,3,6,7,7,7,8,3,7,4,8,6,8,7,7,6,6,8,6,8
,1,6,5,5,5,3,6,4,3,2,8,6,5,4,5,7,8,2),nrow = 54,byrow = FALSE,dimnames = list(1 : 54, c("A",
"B","C","D","E","F","G","H","I")))
> result <-friedman.test(milkflavour)
> result

```

### Friedman rank sum test

data: milkflavour

Friedman chi-squared = 18.8919, df = 8, p-value = 0.01545

```

> Ranktotals<-c(abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[2]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[3]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[4]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[5]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[6]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[1]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[3]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[4]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[5]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[6]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[2]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[4]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[5]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[6]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[3]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[4]]-colSums(milkflavour)[[5]]),
+ abs(colSums(milkflavour)[[4]]-colSums(milkflavour)[[6]]),
+ abs(colSums(milkflavour)[[4]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[4]]-colSums(milkflavour)[[8]]),

```

```

+ abs(colSums(milkflavour)[[4]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[5]]-colSums(milkflavour)[[6]]),
+ abs(colSums(milkflavour)[[5]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[5]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[5]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[6]]-colSums(milkflavour)[[7]]),
+ abs(colSums(milkflavour)[[6]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[6]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[7]]-colSums(milkflavour)[[8]]),
+ abs(colSums(milkflavour)[[7]]-colSums(milkflavour)[[9]]),
+ abs(colSums(milkflavour)[[8]]-colSums(milkflavour)[[9]]),
+ qtkey(0.95,9,999)*sqrt((54*9*(9+1))/12))
> Comparisons
<-c("A-B","A-C","A-D","A-E","A-F","A-G","A-H","A-I","B-C","B-D","B-E","B-F","B-G","B-H","B-I","C-
D","C-E","C-F","C-G","C-H","C-I","D-E","D-F","D-G","D-H","D-I","E-F","E-G","E-H","E-I","F-G","F-H"
,"F-I","G-H","G-I","H-I","critical distance for HSDRanks")
> HSDRank.comparisons <- data.frame(Ranktotals, row.names=Comparisons)
> HSDRank.comparisons

```

	Ranktotals
A-B	21.0000
A-C	1.0000
A-D	30.0000
A-E	3.0000
A-F	4.0000
A-G	6.0000
A-H	9.0000
A-I	28.0000
B-C	22.0000
B-D	9.0000
B-E	18.0000
B-F	17.0000
B-G	15.0000
B-H	30.0000
B-I	49.0000
C-D	31.0000
C-E	4.0000
C-F	5.0000
C-G	7.0000
C-H	8.0000
C-I	27.0000
D-E	27.0000
D-F	26.0000
D-G	24.0000
D-H	39.0000

D-I	58.0000
E-F	1.0000
E-G	3.0000
E-H	12.0000
E-I	31.0000
F-G	2.0000
F-H	13.0000
F-I	32.0000
G-H	15.0000
G-I	34.0000
H-I	19.0000
critical distance for HSDRanks	88.4718